REMARKS/ARGUMENTS

Favorable reconsideration of this application as amended and in light of the following discussion is respectfully requested.

Claims 1-8 and 11-19 are presently active; Claims 20-49 have been withdrawn by a Restriction Requirement; Claims 9 and 10 have been canceled previously without prejudice; Claim 1 has been presently amended. No new matter was added.

In the Office Action, Claims 1-3 and 5-7 were rejected under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over U.S. Patent No. 5,882,424 to Taylor et al. Claims 4, 8, and 13-19 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Taylor et al in view of U.S. Patent Application Publication No. 2003/0151372 to Tsuchiya et al. Claim 12 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Taylor et al in view of U.S. Patent No. 5,441,596 to Nulty. Claim 12 was also rejected under 35 U.S.C. § 103(a) as being unpatentable over Tashiro et al in view of Tsuchiya et al as applied to Claim 11, and further in view of U.S. Patent No. 5,441,596 to Nulty. Claims 1-8, 11 and 13-19 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Japanese Patent Application Publication No. 08-031753 to Tashiro et al in view of U.S. Patent Application Publication No. 2003/0151372 to Tsuchiya et al.

Claim 1 has been amended to define a method of operating a plasma processing system, comprising:

> positioning a substrate on a substrate holder in a processing chamber;
> initializing the plasma processing system;
> igniting a plasma by applying to a first electrode in the processing chamber a first RF signal at a first RF frequency from a first RF source to ignite the plasma and thereafter providing to the first electrode from the first RF source a second RF signal at a second RF frequency so as to maintain the plasma while the first RF frequency of the RF source is being changed to the second RF frequency of the first RF source, wherein the first RF frequency is higher in frequency than the second RF frequency; and
> sustaining the plasma using the second signal applied to the first

> electrode at the second RF frequency,
>
> ***wherein said igniting and sustaining the plasma comprises:***
>
> ***supplying both the first RF signal and the second RF signal through a matching network having only one variable impedance element.*** [Emphasis added.]

The added feature of supplying both the first RF signal and the second RF signal through a matching network having only one variable impedance element is supported by Applicants' Figures 2A and 2B and the discussion thereof in the specification.

Regarding the rejection over Taylor et al, M.P.E.P. § 2131 requires for anticipation that each and every feature of the claimed invention must be shown in as complete detail as is contained in the claim. M.P.E.P. § 2143.03 requires, to establish a case of *prima facie* obviousness, all the claim limitations must be taught or suggested by the prior art.

The outstanding Office Action applies Taylor et al for a teaching of a first RF frequency being higher than a second RF frequency. Specifically, the Office Action cites col. 7, lines 1-13 of Taylor et al, which states:

> For example, a high frequency excitation field can provide more efficient method of igniting the plasma. This high frequency would be in the MHz range, and preferably between about 1-15 MHz. Referring to FIG. 1, initially, the high frequency RF source 24 would be connected to one or both of the electrodes 18, 20 and/or the antenna 22 until the plasma has been generated. Thereafter, the high frequency source 24 would be disconnected, and the low frequency RF source 26 would be connected to one or both of the electrodes 18, 20 and/or the antenna 22 to sustain the plasma during the cleaning operation.

Thus, in Taylor et al, separate power supplies are used in which the high frequency source 24 is disconnected, after plasma igniting, and then the low frequency RF source 26 connected.

Claim 1 defines: igniting a plasma by applying to a first electrode in the processing chamber a first RF signal at a first RF frequency from a first RF source to ignite the plasma and

thereafter providing to the first electrode ***from the first RF source a second RF signal at a second RF frequency*** so as to maintain the plasma while the first RF frequency of the RF source is being changed to the second RF frequency of the first RF source, wherein the first RF frequency is higher in frequency than the second RF frequency. Thus, Claim 1 defines one power source changing the frequency from a higher frequency to a lower frequency.

The Office Action points out Taylor et al describe at col. 7, lines 46-48, that "a single power source might be employed which is capable of generating multiple RF signals of differing frequency." The Office Action construes this to mean that "the first RF source 24 and the second RF source 26 can be replaced by a single power source." Applicants respectfully point out that context of Taylor et al description of using "a single power source . . . capable of generating multiple RF signals" is in the context of providing mixing signals to a pre-existing plasma. Taylor et al describe at col. 7, lines 49-50, that the "key point is that a mixed frequency excitation is produced by simultaneously coupling high and low frequency RF signals to the plasma." The examiner's attention is directed to col. 7, lines 14-15, where Taylor et al explicitly state that "the high frequency source could also be left on to provide a mixed frequency excitation of the plasma."

Thus, the teaching in Taylor et al at col. 7, lines 46-48, cited in the Office Action for a teaching of a single power source, is directed to the application of mixed frequency excitation to a pre-existing plasma, and is not as in Claim 1 directed to the igniting at a higher frequency and the changing of the frequency with the single power source to a lower frequency operation.

Rather, it is only the teachings at col. 7, lines 1-13 of Taylor et al, noted above, which is specific to plasma excitation at a higher frequency and the changing of the frequency to a lower frequency for plasma maintenance. Yet, in that disclosure as noted above, Taylor et al clearly

teach separate, disconnectable power supplies. Accordingly, Taylor et al do not disclose or suggest the above-noted features of Claim 1, but rather ***teach away*** from the claimed invention.

Moreover, Claim 1 as amended defines supplying both the first RF signal and the second RF signal through a matching network having only one variable impedance element. There is **no** description in Taylor et al of the details of impedance matching networks 42 and 46 described therein. Conventional matching networks typically need two variable impedance elements to tune and load match the RF source to the RF load where power is being dissipated.

In view of these considerations, Applicants submit that Claim 1 and the claims dependent therefrom patentably define over Taylor et al.

Regarding the rejection over Tashiro et al and Tsuchiya et al, the Office Action disagrees with a number of points raised by Applicants in the last filed response. The Office Action continues to assert that it would have been obvious to one of ordinary skill in the art to modify the method of Tashiro et al to have the first RF frequency used to ignite the plasma be greater than 40 MHz and more than 10% higher in frequency than a second RF frequency used to sustain the plasma. See page 10 of Office Action.

Firstly, Applicants point out that the numerical limitations are not in Claim 1. Moreover, as the examiner has noted in the Response to Arguments section of the Office Action, it is the reasonable expectation of success test which must be applied in order to ascertain obviousness of the asserted modification.

Indeed, Applicants have pointed out the degree to which the unreliability of the equipment as disclosed in Tashiro et al would discredit any general advantages of higher operational frequencies discussed in Tsuchiya et al. Presently, Applicants point out not only

how their previous arguments mean that there is no reasonable expectation of success, but also additional corroborating evidence in Tashiro et al to this effect.

Prior to Applicants' invention, there was no reasonable expectation of success that the method of Tashiro et al could be modified to have the first RF frequency used to ignite the plasma and a second lower RF frequency used to sustain the plasma. Applicants have pointed out that, in Tashiro et al, it is stated at paragraphs [0015] – [0016]:

> If the frequency is about 13.56 MHZ, the stray capacitance and the stray inductance are negligible, compared with L/4 and C_2 of the matching unit, however the frequency rises to a VHF region, the stray capacitance and the stray inductance cannot be ignored. In other words, if only the matching unit is employed, ***matching is difficult due to the stray capacitance and the stray inductance***. In an actual VHF discharge, if condition (2) was met, the discharge start was very difficult. Furthermore, even if the discharge was carried out, the matching was difficult to be attained, and time was required for the matching.
>
> For these problems, the discharge has been started by increasing the input power, and while attaining the matching, the power has been set to a prescribed value. However, in this method, ***the overload to the power source*** becomes a problem and there has been a limitation in the realization. Furthermore, since the film formation rate is vary fast, if ***the time required until a stable discharge through the matching after the start of the discharge is long***, a film is deposited in the meantime, so that a uniform film has not been able to be formed or at least the initial film has been nonuniform. This is ***a big problem*** for manufacturing apparatuses in which the interface is an important requirement. [Emphasis added.]

This is evidence of the lack of a reasonable expectation of success that a single power source could be used to start at a higher frequency and slew to a lower operating frequency, when viewed in the light of the problems disclosed in the prior art (i.e., the stray capacitance and inductance leading to power source overloads).

The Court in *In re Dow Chemical Co.*, 837 F2d 46, 5 USPQ2d 1529 (CAFC 1988) stated that:

> The consistent criterion for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that this process should be carried out and would have a reasonable likelihood of success, ***viewed in the light of the prior art***. [Emphasis added.]

In other words, for one of ordinary skill in the art to modify the method of Tashiro et al to have the first RF frequency used to ignite the plasma be greater than 40 MHz and more than 10% higher in frequency than a second RF frequency used to sustain the plasma, as asserted in the Office Action, would require one of ordinary skill in the art to perform extensive experimentation to arrive a set of matching conditions and equipment which would accommodate the stray capacitance, inductance, and power supply overload problems noted by Tashiro et al.

Indeed, Applicants position on this matter is corroborated by the description of Tashiro et al at paragraph [0022] of a solution for a VHF plasma discharge start, **but** a solution that involves different electrodes for VHF and RF discharges utilizing two different matching units and two different power sources. Thus, for one of ordinary skill in the art at the time of the invention, the only reasonable expectation (when viewed in light of the prior art) was to ignite the plasma at a higher frequency and to sustain with a lower frequency using different electrodes for different VHF and RF powers sources.

Thus, Applicants submit that, when these considerations are weighed, the combined teachings of Tashiro et al and Tsuchiya et al would not motivate one of ordinary skill in the art to modify Tashiro et al based on the generic principles expounded in Tsuchiya et al for operation at higher frequencies, as asserted in the Office Action.

Secondly, the Supreme Court in *KSR International Co. v. Teleflex Inc. et al. 2007 U.S. LEXIS 4745* reinforced the role of teaching away and unexpected results in deciding obviousness. The Court stated that:

> In *United States v. Adams*, 383 U. S. 39, 40 (1966), a companion case to *Graham*, the Court considered the obviousness of a wet battery that varied from prior designs in two ways: It contained water, rather than the acids conventionally employed in storage batteries; and its electrodes were

> magnesium and cuprous chloride, rather than zinc and silver chloride. The Court recognized that when a patent claims a structure already known in the prior art that is altered by the mere substitution of one element for another known in the field, ***the combination must do more than yield a predictable result.*** 383 U. S., at 50-51. It nevertheless rejected the Government's claim that Adams's battery was obvious. The Court relied upon the corollary principle that when the prior art ***teaches away*** from combining certain known elements, discovery of a successful means of combining them is more likely to be nonobvious. *Id.*, at 51-52. When Adams designed his battery, the prior art warned that risks were involved in using the types of electrodes he employed. The fact that the elements worked together in ***an unexpected and fruitful manner*** supported the conclusion that Adams's design was ***not obvious*** to those skilled in the art. [Emphasis added.]

In the present situation, the claimed method involving supplying both the first RF signal and the second RF signal through a matching network having only one variable impedance element produces ***more than predictable results*** which Tashiro et al show to have been 1) difficult matching and 2) power supply overloading leading to "a big problem" for manufacturing apparatuses.

Indeed, to avoid known problems with using one power supply to start the plasma and then slew to lower operational frequencies, Tashiro et al ***teach away*** from the present invention by their use of a system having two separately powered electrodes driven by separate power supplies in order to strike at a lower RF frequency and maintain at a higher VHF frequency. See numbered paragraph [0025] of Tashiro et al.

Thirdly, Applicants point out that recently the Patent and Trademark Office has provided guidelines for obviousness based on *KSR*. These guidelines point out that:

> The proper analysis is whether the claimed invention would have been obvious to one of ordinary skill in the art after consideration of ***all the facts***. [Emphasis added.]

Moreover, with regard to modifying claim elements, the guidelines point out that the following must be shown:

(1) a finding that there was some teaching, suggestion, or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings;

(2) a finding that there was reasonable expectation of success; and

(3) whatever additional findings based on the *Graham* factual inquiries may be necessary, in view of the facts of the case under consideration, to explain a conclusion of obviousness.

Here, as noted above, there is **no** reasonable expectation of success when prior art problems such as stray capacitance and inductance and power supply overload are taken into consideration.

Fourthly, Claim 1 as amended defines supplying both the first RF signal and the second RF signal through a matching network having only one variable impedance element. Neither Tashiro et al nor Tsuchiya et al teach a matching network having only one variable impedance element. Indeed, Tashiro et al show in Figure 9 a conventional matching network having two variable impedance elements. There is **no** description in Tsuchiya et al of the details of impedance matching element 41 described therein.

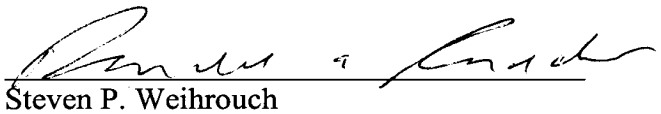
In view of these considerations, Applicants submit that Claim 1 and the claims dependent therefrom patentably define over Tashiro et al and Tsuchiya et al.

Conclusion: Thus, for all these reasons, it is respectfully submitted that Claim 1 and the claims dependent therefrom patentably define over the art of record.

Consequently, in view of the present amendments and in light of the above discussions, the outstanding grounds for rejection are believed to have been overcome. The application as amended is believed to be in condition for formal allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.



Customer Number
22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 06/04)

Steven P. Weihrouch
Attorney of Record
Registration No. 32,829

Ronald A. Rudder, Ph.D.
Registration No. 45,618

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